Transcript of videotaped interviews
by Maria Tome
with people in Colorado
who had been involved in
Colorado's oxygenated fuels program

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Interview with Jerry Gallagher, Ph.D.
Manager, Vehicle Emission Control Program
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Monday, October 17, 1994

Gallagher: (showing an engine intake valve with deposits)...It's got a brownish color to it. The other one's fairly clean...

The easiest thing to do was always pick on the new kid on the block and alcohol fuels were new and so everyone wanted to blame the alcohol fuels for the problems.

This was..back in eighty-six, eighty-seven. We took these to the laboratory, found out that it had nothing to do with the alcohol. It was basically the lack of detergents in the gasoline. Obviously over the years, detergents have become a very major component of gasoline. These are the kinds of things that happen. Even people that seem to have a pretty good background can cause a lot of problems.

The bottom line I guess was the parts compatibility and everything was really not an issue. As long as you can make good quality control, as long as you control your vapor pressure, control your water and everything else that you would normally with gasoline.

In fact, a state just east of us, Nebraska, has been selling forty and fifty percent gasoline with alcohol fuels well before we were involved with it because they were a farm community and they supported the fuel. It was OK forty miles away from here ... We had problems here and you didn't have problems forty miles away? Obviously, that didn't make a lot of sense.

" The easiest thing to do was always pick on the new kid on the block and alcohol fuels were new and so everyone wanted to blame the alcohol fuels for (vehicle) problems."

The tank issues is pretty straightforward. It's like anything else. You have to have good quality control.

We probably have one of the largest number of small, independent, small ma-pa gas stations in the country. That's where we keep our prices. In fact, they're pretty competitive. We have a lot of distribution with our pipelines and small retail shops. But we were concerned about low turnover, low volume turnover, older tanks. And we got with the alcohol industry and came up with a good manual on how to prep up a tank. The manual was very simple. The cost was, you know, three, four hundred dollars, to clean these tanks. Basically cleaned the tank, make sure you had your moisture out, put your dipstick in, make sure the moisture was gone. We usually put a filter, thirty, forty dollars, to put a filter on the pump for the first time.

There was a lot of concern that because our program was gonna be in the winter, not in the summer, that you had to do this every year. You're going to have a cost of thousands of dollars to do this. In essence, that's not what happened. Once you keep a tank clean, once you get the water and sludge that's in there anyway, once you get it out, get it cleaned, it was not an issue to

change these tanks back and forth with out a problem. Um, pretty straightforward. We've worked with a small companies, point out the cleaning, test the fuels... was really not an issue.

There were some concerns about some fiberglass, you know, couldn't take methanol. You got these flex fuel stations going on in California and they're expensive... Everybody was confused about a simple blend of gasoline which was certainly not anything like the M85 gasoline. So everybody wanted to mix apples and oranges in the process.

MLT: We've been coming across the same thing (chuckle) ...were there actually any problems with tanks not being ethanol compatible?

Gallagher: No. Bottom line, no. I mean a lot of people thought so but in essence, there wasn't any problem out there we had. Fifteen, sixteen hundred service stations out there, you know, with multiple tanks. In essence, there wasn't any problem. We got them prepped, got 'em in time. We've been doing this now since eighty-six. In eighty-seven, we really got started with this whole thing.

"Were there actually any problems with tanks not being ethanol compatible?"

"No. Bottom line, no. Fifteen, sixteen hundred service stations out there, you know, with multiple tanks. In essence, there wasn't any problem."

Back in eighty-one and eighty-two, as much as twenty percent of all our gasoline sold in the summertime in Colorado was an ethanol blended fuel. And we used to have a gasohol promotion committee which was sponsored by the state legislation and the Department of Agriculture to promote the use of alcohol, promote the use of corn and grain use in the state of Colorado for an alcohol as a fuel extender. And as what we called the Nickel Bill because actually, we had a state tax credit that we could give the producers of alcohol in this state. That bill eventually went away but we actually gave an additional nickel credit. We were selling as many, like I said, as much as eighteen percent.

But now..we're looking at probably sixteen to seventeen percent of the gasoline sold in the winter is an ethanol blend. Somewhere between seven and a half and ten percent ethanol. And the only reason it varies between the numbers is what's the best tax credit. You can get a tax credit ... it can be either 7.5 or it can be ten percent. Ten percent is the max.

We're excited about the fact that ethanol is being used in ETBE because we think that ETBE itself, not necessarily because it's ethanol, but because the fact that ETBE has a little vapor pressure and has some good characteristics of gasoline blends that we think will help. Environmentally, it'll help in the long term.

I'd look at the whole issue of just what do you do with some of your waste products. There's a lot of waste products in our country that we could probably get environmentally and engineering-wise and energy-wise that we should probably be looking in the future if we're using some form of ethanol. Seems pretty foolish to buy oil and then burn that if we have some other resources available to us.

MLT: Ok. How about the obstacles you faced when you first started this?

Gallagher: The biggest thing we had was an enormous amount of confusion right away. The oil industries were not too pleas.. not too happy about selling a product they didn't have control of. Obviously there were enormous amounts of money invested in this process.

There were concerns of distribution, tank storage. Was there enough tankage... ETBE, you can ship by pipelines. Ethanol by itself, you can't. I mean you can but you don't because of the water contamination of the pipeline. So ethanol has to be shipped by rail or by car. MTBE or ETBE can be shipped by pipeline. So there were concerns of enough tankage, separation of grades of fuel ... the distribution, the marketing issue.

It was the fear of the unknown more than anything else. We hadn't done it before. We don't know how to do it. We didn't know what it was going to cost. A lot of that came up. And then the whole driveability issue that the old cars are going to stop in the middle of the street. You know, the school bus is going to stop on the railroad track. We had a lot of issues.

"It was the fear of the unknown more than anything else. We hadn't done it before. We don't know how to do it. We didn't know what it was going to cost."

MLT: Did the cars and the buses...

Gallagher: No.

MLT: Most of the cars and buses, no?

Gallagher: Bottom line, no. But we were concerned. I mean, this was a major change, you know, and obviously the political people were concerned, the technical people were concerned and we certainly didn't want to get out there and put a program in that would help out the air pollution program but cause a panic issue.

"... the whole driveability issue, that old cars are going to stop in the middle of the street ... the school bus is going to stop on the railroad track..."

"Did the cars and the buses...?"

"No."

So, we all did a lot of testing on our own. We could not see this. The literature didn't support it. The literature nationally didn't support the issue. So, what we did though, the Governor was concerned, that we do a pilot program. We ran hundreds of cars on a double blind study prior to the start of the program where we took vehicles that were in the state government fleet where you had the driver normally drove the same car and did not fuel his car. The fuel was usually fueled by an attendant at the motor pool. What we did was we switched the fuels back and forth on a random sample every two weeks. We used straight gasoline. We used ethanol. We used MTBE. We ran the program for several months. We had weekly surveys. The program, we did

fuel samples, we did parts compatibility. We took fuel pumps off. We took injectors off. We did everything we can.

The bottom line was there wasn't a problem. The drivers normally couldn't tell any difference between one fuel or the other. Our program did have MTBE and MTBE does have an odor. And the odor issue can be offensive. And people were concerned because it smells bad, it must be bad.

The ether odor ... you know, smells like ether. I don't know if you've been around an emergency rooms or anything else but it has a sort of bad odor to it. You could pick it up, you know, at 2% percent level and above you notice it. We did some homework with the drivers, truck drivers. We had truck drivers that called in here saying they had headaches. They had some concerns. We met with them. We got, you know, good research people. We had epidemology people to deal with the truckers. Like any other chemical, it takes good practices. The practices were you make sure you were upwind or downwind. You didn't stick your nose in a five hundred gallon or ten thousand gallon truck of any chemical. I think once they understood that the threshold of the odor would be there. I think the most important part of the MTBE issue was that once you got away from it, take a good breath of fresh air upwind or downwind from it once you're away from it, usually it went away.

There was a lot of concerns that there was gonna be a lot of toxins from this. People didn't realize that gasoline itself is a cancer-causing chemical. It's a toxin. Benzene's in there that you probably really don't want to use anyway. And so, in one respect, maybe the little bit of odor helps because maybe people would tend to keep their noses out of their gas tanks when they fill it up. But everybody thought that all these toxins were based because the alcohol or MTBE and they weren't. They were basically toxins that were in the gasoline itself.

We met the small distributors, told them, you know, these things change. You have to do these things right. If you do it right, it's no different than a gasoline spill. You know, you could spill gasoline in a creek just as bad as you know, tip over a tank of gasoline and if you tip over a tank of gasoline that's got ethanol in it, you have to use common sense and same practices. In the MTBE issue, we worked with the fire departments, emergency squad, in case a truck of pure MTBE would tip over and dump. You wanted to be sure a bunch of fire department volunteer people just didn't rush in and not realize. Normally what happened is that you get dizzy, get headaches and you'd figure that something's wrong.

Well, we wanted to make sure that we had information. We had pamphlets available and I think we did a pretty good job of that part of it. That parts compatibility thing, we had a lot of local phone calls that “gee, you know, my car doesn't work today, it worked yesterday.” We had people call (the program had started January 1 and we had staff in here New Year's Day) .. their cars wouldn't work that day. But they worked fine the day before. They didn't realize that the fuel had been in place in the system almost a month because it takes about a month to change over the system so ethanol and MTBE had been in the system for almost a month and not a phonecall. But January 2, we had phonecalls. We received about 2000 phonecalls the first year. Mainly just complaints of unknowns, the fear.

“We had people call (saying) their cars wouldn't work... The fuel had been in place in the system almost a month and not a phonecall. But (the official start of the program was January 1) January 2, we had phonecalls.“

We had one radio station that really... well I think was anti-everything. You know, anti-government, anti- (?). You know, of course, this was a government program. Something had to be bad. And they said to make sure pregnant women didn't go to the gas stations. And if you had kids in the car, make sure you had the windows rolled up. I mean it was just really ridiculous. And some local television stations. None of those things, unfortunately, were true. But obviously it causes panic for people who don't know. I don't think it did justice to the community. All that stuff had disappeared after that first year. We're down to fifteen, twenty, phone calls a year now. You know, we're talking about two million people we're selling 350 million gallons of this stuff a year. And they drive forty, fifty, millions a day on this stuff.

We have cars that are 1960. We have a very old vehicle mix. That was another concern. Our cars don't rust nearly as frequently. We don't use salts for the winter. We have, a good example, right now 350,000 vehicles that are pre-81 vehicles that operate in Denver. We have an older than the normal population of vehicles in the country. So there were a lot of concerns if a '62, '63 Chevy pick-up truck wasn't going to run or wasn't going to go as far as it could and things like that. It didn't happen. It just didn't happen.

We knew there were some concerns that occasionally if you use some alcohol the first time through, the fuel filter would plug. That was one thing. That we were going to plug all these fuel filters on some of the older cars, pre-75, in particular. We got with the car manufacturers and they said yah, we made these tanks twenty, thirty years ago and you know, there's some possibility there's some rust and sludge in them and the alcohol could clear that out for the first time, plug the filter and after you change that filter, it's OK. So everybody thought, of course, everybody's filter was going to plug the first day and we did a lot of work with the parts, parts manufacturer's house, you know, the Napas of the world and the Checker's Auto Parts.

We went back into Nebraska and we went into different places that had used this to see was there a difference in fuel filters being sold, fuel lines being sold, fuel pumps being sold. We tried to every analysis we could and we couldn't find anything different. I think they even sold more fuel filters in Omaha than they did in Denver. If all this was going on, there ought to be a lot of fuel filters being sold. It didn't mean that it wasn't gonna happen occasionally. But in essence, we didn't see that. I'm not saying that a fuel filter won't plug, it certainly will occasionally but it was, we never heard about it. I mean, if one went out and there was occasionally one and it was probably there to begin with. A lot of these fuel filters, you know, are supposed to be changed every year. And if you do a survey, you'd probably find out they haven't been changed every year. So we went through that whole issue.

I think just trying to be honest with the public, trying to be upfront with the mechanics and trying to say there was some precautions and these kinds of things are going to happen. But in essence, things worked out. There was some hassles, phone calls about individual cases. We'd go get the vehicle. We'd go look at it find out that it had nothing to do with the alcohol fuels. In fact, we never did document one in all the ones we did look at and we looked at dozens and dozens of vehicles, handfuls of phonecalls to follow up. We never did document one in millions of gallons of gasoline.

"We'd go get the vehicle. We'd go look at it find out that it had nothing to do with the alcohol fuels. In fact, we never did document one in all the ones we did look at."

One of the problems we first had was the amount of rail cars to get the ethanol in. There was a distribution problem up front because they didn't lease enough of the rail cars. You know, you get

little things like that. But the oil companies got their tanks, the vault tanks on-line. The rail cars showed up with the alcohol because most of it of course was coming from the Midwest. The tanks got cleaned out ahead of time. Things got cleaned out. The fuel got delivered and everything worked fine.

MLT: So pretty much the public concern died down, once the first year of the program had been completed...

Gallagher: We went down like from 2200 phone calls down like 50 the second year. This year, the fuel starts November 1. In fact, right now there's MTBE and ethanol in all the tanks. The people just don't realize it. And we still get phone calls from owners on the MTBE issue. Mainly they just don't know. "I brought my car from sea level. It's an old car and I'm bringing it to Colorado with your fuel." You know, "is my car gonna be different." We have military people that have cars, students, you know, everything's different they realize. They just don't know. They heard some war stories and everything else.

Working with the mechanics was probably the biggest mistake we made -- not spending enough time with them. We didn't think that. We thought they'd understand they issues better than they did. But what happened was, there was a lot of things going on with the fuels that particular time of the year. The vapor pressure was increasing. Detergents weren't nearly as good as they are today. There was a lot of things. The auto industry hadn't redesigned the vehicles to be concerned more about vapor lock. Fuel lines were sort of real close to you know, the hot part of the engine where they shouldn't have been. So there was a lot of things that were that was going on at the time.

"Not spending enough time with the mechanics was probably the biggest mistake we made. We thought they'd understand they issues better than they did."

And what happens is that some of these fuel problems would show up and the mechanics just couldn't figure out what it was. It was really easy to find somebody a whipping boy. And the alcohol program was exactly that. "We can't fix this thing. It must be the fuel." And not realizing that there was a lot of things going on. You know, if it was because of the fuel it wasn't because of the alcohol. I think those things aren't happening today. Understanding the fuel, understanding detergents, deposits, rust inhibitors, all those things that need to be put into gasoline were probably not well defined. I think because of this, because of the reformulated fuel issue, I think the fuels are a lot better. Technically, they are a lot better. A lot better fuel. People understand it better.

MLT: Good. Anything you want to mention...How to survive the first year.

Gallagher: Yah, there was, there was. That's probably a good book, "How to Survive."

I think that you've got to be upfront with some key people.

If you happen to have an automotive race car driver (people don't realize, you know, that has nothing to do with the issue). But we play the same game of "you know, the Indianapolis racers have been running on methanol for years." But those cars have been designed for methanol. So I mean, what we try to do is get some people with some technical background.

We try to get some of the vocational teachers / instructions in line. We try to get some people that had at least earned some respect on the technical side that were out of the bureaucratic side, that were out of government. That helped.

We didn't do enough of that but we started that. It did help. I think there's good literature available, the "Changes in Gasoline." There are some things in there for the mechanics. I think trying to do some of those things that are important upfront, realizing if you do it right, there's nothing wrong with it. And our job was to make sure it was done right. And it was also the job of the industry.

They were concerned because they didn't want to. And even at the same time, they brought this thing all the way down to the line, once they had to do it. The oil industry can make a good gasoline blend, once they decide to do it. They know how to make gasoline and they know how to make it right and they know how to make it work.

"The oil industry can make a good gasoline blend, once they decide to do it. They know how to make gasoline and they know how to make it right and they know how to make it work."

You got General Motors finally coming aboard. If you could bring some of the technical people outside of the government, that understand the program. Talk to them ahead of time. Try to get involved with it. Try to talk to the editorial boards ahead of time. Take one of those kind of people with you when you go. Or your local newspaper...so a person doesn't pick up war stories from someplace else. Once you get those out, they're really hard...

So you can be upfront. Be honest with the people. Be upfront. Have a core of people that really understand what you're doing, why you're doing it. As much as you can do of that ahead of time. Have your fact sheets in line. Have all your information available. Have all that stuff in place well before you think you're gonna get into the process.

Make sure the people that are going to influence public opinion are at least well educated. If they're ?? that's OK. I think our problem was our people didn't have a clue what they were talking about most of the time. They were just confusing.

MLT: You mentioned you had put together some kind of manual or how a prep your tank.

Gallagher: Oh, sure. We should be able to get you those.

MLT: Thanks a lot. I got some ideas on how to get uh...

Gallagher: I think the key thing is to find out who's going to help me, who's going to be against me and what are, you know, what are the concerns. You're certainly doing you're homework now. And the thing is locally ... every state's different. This is a farm community. If I was doing this in Omaha (phone ring), no big deal. Told you it was going to ring.

MLT: That's OK.

Gallagher: Ok. And I think if you, if you could figure out who's editorial boards, who's, who's the main ?? reporter. Who's gonna be against this kind of thing.

Hollman: Back in the 1980's there was a state tax subsidy on ethanol so it was fairly common, reaching a market share of about 20% during that time period. We started our oxygenated gasoline program in 1987 as a air quality measure and it's been in use since that time.

MLT: Were there any kind of problems encountered when you first started? For example, in 1987 [..?..]

Hollman: There was the fear of technical problems much more than there were technical problems. Of course there's always the possibility with ethanol blends. As time rolls forward, it's less of a concern.

Back in the 70s, not all vehicles were compatible with ethanol. You might have some problems with carburetor components, fuel lines, and things. But since ethanol has been used across the country since the 70's, these components have changed. Replacement parts are compatible. The first year of the program, we were very concerned about that, and some of the opposition to that oxygenated fuel program were planting some doubts in that general area.

So we tried to track the sale of carburetor parts, fuel filters, rubber fuel lines because if that were true, the sales of those components should have gone up significantly.

We could not see any difference during that time period. We made a conscious effort to track that during the first year of the program, and it simply didn't occur. We even talked to some parts suppliers that, hearing the same story, anticipated that and had planned on stocking up some of those parts for this area. They did not see any increase in sales.

MLT: Are any of these part suppliers still around...

Hollman: One of the problems, as we tried to track that, is separating out just those part numbers. If you could arrange that in Hawaii ahead of time, try to identify ahead of time, say through a major parts chain and see if they could work with you on that, yeah, that would be a real good way to track that. I would anticipate it's going to show the same thing that we saw, that it didn't increase over those parts over the normal range you'd expect. I mean, those parts wear out.

MLT: yeah... (in agreement)

Hollman: And that's why they're in parts houses to start with.

MLT: Um, are there any local repair uh, auto repair shops or anything like that? Maybe I should talk to them and find out if they have any comments about the effect of fuel on the cars.

Hollman: What we found is they will find you. If there's some repair places that believe that the fuel is causing those problems, they or their customers will be in touch with you.

We ran some technical assistance centers that were staffed by mechanics. If a person called in a complaint, we brought some of these vehicles in and tried to identify the complaint. And in every case where we did that, we always found some other situation that was going on that was being

blamed on the fuel. For instance, with oxygenated fuels, when you add ethanol to gasoline, you're shifting the fuel-to-air ratio so sometimes that can uncover other existing problems such as a timing problem, a vehicle in need of a tune-up. So it would sometimes, some vehicles will operate differently on ethanol blends. A lot of times it simply uncovers a preexisting problem.

MLT: Are there any technical problems from the fueling aspect with the service station tanks or fuel pumps?

Hollman: There's some considerations when you switch from a hydrocarbon fuel to an ethanol blend. It's nothing new, it's been going on through the Corn Belt, through the Midwest that introduced ethanol back in the seventies... One concern, ethanol will absorb water, it is a solvent so it'll loosen any grunge that's at the bottom of the tank. So your tanks do need to be checked to see if they are clean. A lot of times when first introducing ethanol and on through while it is being dispensed, there will be a final filter added to the nozzle to pick up any impurities or any water that's been loosened. That's a pretty straight-forward procedure. It's a good quality check that perhaps should be done anyway. Um, as far as your tanks, or seals for the filter cap, if it's any recent tank, there shouldn't be any problems. In other words, if it's a tank that's not leaking at the time that's, uh, being brought about through other EPA regulations for underground tanks, there won't be any problems at all with that.

"Are there any technical problems .. with the service station tanks or fuel pumps?"

"Ethanol will absorb water; it is a solvent so it'll loosen any grunge that's at the bottom of the tank. So your tanks do need to be checked to see if they are clean. A lot of times ... there will be a final filter added to the nozzle to pick up any impurities or any water that's been loosened."

MLT: How about the old "Mom and Pop" type stores? Is there any concern where they can't afford to do anything?

Hollman: Well it's a fairly minor change as far as cleaning your tank, having it checked. Then again, sooner or later they're going to have to clean out that tank if there's some water impurities collecting at the bottom of that tank anyway. So it's nothing different than what is routinely done. Perhaps it's going to speed up that time frame. The filter is something whoever they're doing business with from the ethanol will likely supply at a reasonable cost. So it's not a major consideration. As a rule, at least what we've seen, ethanol is usually a cost effective component to add into gasoline. There's federal tax subsidies for it, so there's usually a cost savings in many cases. It depends on the localized market but, um, there's actually savings that it can absorb those costs.

"How about the old "Mom and Pop" type stores?"

"It's a fairly minor change as far as cleaning your tank, having it checked. Then again, sooner or later they're going to have to clean out that tank if there's some water impurities collecting at the bottom of that tank anyway. So it's nothing different than what is routinely done."

MLT: The last legislative session, it was suggested that we try to implement a tax credit for some kind of payment to, for example, the "Mom and Pop" stores that if they were to incur expenses, we would help reimburse that. And then we started to discuss what would be needed and then, you know, they were coming up, well $500 and then somebody else came up, well gotta replace the whole tank. So somewhere, in there, what would be reasonable if somebody was determined to come up with answers to make this easier for smaller service stations? How much do you think we should expect?

Hollman: My advice would be to check with some of the ethanol vendors, even in the Colorado area or any of the vendors that carry ethanol. Uh, I couldn't quantify that. I don't think it's a large expense. I think it's a routine type of expense you have with being in the gasoline retail business. Um, we didn't see the need for helping out with the small stations. We did not observe a large economic impact as a result of bringing ethanol into our market. Maybe something worth mentioning too. In your program, you're talking about an ethanol program. In our program, it's an oxygenated fuel program, where the marketer has a choice between ethanol and MTBE. So that's one difference and the program we run versus what you're maybe implementing in Hawaii.

MLT: I seem to recall the use of ethanol increased over the years and the percentage of the market share....

Hollman: Yeah, as I was saying, we simply set an oxygen requirement. We don't say which oxygenates you should use. When the program first started, and this was in January of '88, um, uh, 96% of the gasoline was blended with MTBE. Only 4% with ethanol.

And that shifted each year and it's shifted strictly due to the price of ethanol, the comfort level of the different marketers carrying ethanol. There was some bad press when I first started the program, so even though ethanol, always in our market, has been cheaper than MTBE, there was some market resistance because people were afraid they'd might lose market share if they go ethanol. So as that comfort level has increased, more and more people have increased ethanol. This year, the season we had just completed, we predict we had 7% ethanol. So it's changed from 4% up to 7%. This next year, we're anticipating next time it's going to be predominantly ethanol with a very minor MTBE share. Possibly a complete flip-flop, but that remains to be seen. Like say, we tried to stay out of the market place when an economic decision was to be made by the refiners, blenders, motorists.

MLT: Are there any benefits to having ethanol in gasoline. I guess in your case, it would be, but what about having oxygenated fuels (?) in your program?

Hollman: We brought this program in as a carbon monoxide control strategy. By adding the oxygen, you shift the fuel to air ratio, you lean out the mixture so get a reduction in carbon monoxide and for this last year, we predicted a 25% reduction in tailpipe emissions, a pretty substantial decrease. There's other benefits. For instance, other parts of the country carry it as a agricultural support or when you add ethanol or other oxygenates, you're increasing octane, so you get a benefit there. There's a cost offset where other components being out into gasoline, they increase the oxygen then it can be backed (?) out. There's air quality benefits. There's energy security benefits on having a renewable product that's produced rather than using imported oil or diminishing the amount of oil imported at least by 10% for each gallon it's blended in. It depends on the perspective on the goal. We're pretty focused being the air pollution control division here in Colorado, just for that goal, but we've recognized there are other benefits.

"We brought this program in as a carbon monoxide control strategy...for this last year, we predicted a 25% reduction in tailpipe emissions, a pretty substantial decrease."

MLT: Ummm... I ran out of questions. (laugh)

Hollman: No... good! Hehe... (pause) I could add, our program, when we first started, it was very controversial. There was a lot of opposition. The conclusion we came out to is it was our air quality control commission, a citizen board had put this on their program through their regulatory voting.

We believe that opponents to the program realized that they didn't have the technical basis to oppose the program, and so it was basically taken public, yeah it probably was (?). There was a huge media fight. There were numerous times when our oxygenated fuels program was headlines of both Denver papers. There was... we came close to a public backlash, a legislative backlash to the program. But we felt we had good enough facts on the program, that it was a solid enough air quality strategy that it carried us through all that.

"When we first started, it was very controversial. There was a lot of opposition."

What we found over time from the media attention, people were very concerned what was going to happen to their cars, what was going to happen to the price of gasoline. When we first started, that sharply diminished. By the second year of the program and by this time, we're going to enter the eighth year of the program. We rarely get a call. It's one of the least frequent calls we get into the office now of all the air quality programs we run. It's a very passive program for people. They fuel up their car. They drive just like they always do and they get an air quality reduction. Most other air quality measures, you have to stop burning your wood-burning stoves, stop running your car, get your car inspected. So people get used to it, realize some of the catastrophic problems that were being predicted didn't occur and go about their daily business.

"...opponents to the program realized that they didn't have the technical basis to oppose the program, and so it was basically taken public...There was a huge media fight."

MLT: After you live through the first year, you're OK. (shared laugh)

Hollman: Smooth sailing. And I think in other parts of the country where ethanol is bought, for instance, through some the Corn Belt states where it's subsidized by both the federal government and the state. People shop "price" for gasoline. They don't go about worrying about what component is in their gasoline. If it's priced right, if it gives their vehicle good performance, that's all your looking for in gasoline.

"There were numerous times when our oxygenated fuels program was headlines of both Denver papers. We came close to a public backlash, a legislative backlash to the program. But we felt we had good enough facts on the program, that it was a solid enough air quality strategy that it carried us through all that."

MLT: Yeah, OK. (lengthy pause) (to a second, unseen person) Can you think of anything? (indecipherable) OK. Older cars.

2nd man: (indecipherable)

MLT: How about older cars? You mentioned, let's say we have some 70s' models on the road. How should we handle those vehicles? Should we make sure they can have access to non-ethanol blends? Are we going to have to reimburse the purchase of new parts?

Hollman: One thing that, let me answer that a little indirectly and see if that applies to your situation. One thing I think that's really worked for our program is we've always provided choice. There's always been ethanol and MTBE out there. There hasn't been a forced mandate of using one product, and I think that's had a lot to do with the success of our program. For older cars, if there's a choice for people to use ethanol, if they are strongly opinionated that it will damage their cars.

There again, a lot of what we're dealing with is perceptions. I think that would go a long way to solving that problem and would be an easier solution than subsidies for cars that may or may not have been damaged by ethanol.

"One thing that's really worked ... is we've always provided choice ... there hasn't been a forced mandate of using one product, and I think that's had a lot to do with the success of our program."

Carburetors on 1970 vintage cars go out. Was it the ethanol or was it that it's a 30-20 year old car? There again, by having our choices there, I think it solved a lot of that. One of our biggest concerns that could occur, it doesn't occur in most cases, but could occur with an older car. There again, it's the same problem with underground storage tanks. You have a 25 year old vehicle that's been accumulating varnish, sludge, dirt at the bottom of the tank and with normal gasoline, it just sits there. It really doesn't hurt anything. With ethanol being a solvent, it's going to loosen that up, move it through the fuel system, could cause a fuel filter to be plugged, when ethanol, if it's being used for the first time in that vehicle. So there's a possibility for the problems. Also you get back to that vintage of car, say the carburetor has never been rebuilt, you have some old components. It could, could, and not inherently, but it could speed up the deterioration of some components, if they have the type of rubber components that really weren't compatible with ethanol when it was made. If that 1970s car ever had a carburetor rebuilt in the last five to ten years, chances are very good the type of replacement parts are compatible with ethanol. So yes, it can happen but it's probably going to be more of a rarity than the, the norm. (indecipherable section)

"..a lot of what we're dealing with is perceptions."

MLT: Oh, how about the effects of the fuels on the fuel economy?

Hollman: We've done a fair amount of testing on that topic and needless to say, it's come up over, time and again. Ethanol does have a lower energy content than the gasoline it's displacing, the 10% gasoline it's displacing.

There again, going back to the older cars, older cars tend to be calibrated very rich. When you add the ethanol, it leans the mixture. We've actually seen fuel economy increases on older cars. That's not going to be most of your cars, but that will happen to some vehicles. Other vehicles may see a slight difference. We've seen an average of one to three percent with some. Have seen some vehicles that actually see higher, greater decreases of fuel economy than that but most we see it averaging in about to one to three percent range. So yes, there is some truth to that.

MLT: What about the ones that have the greatest decrease in fuel economy?

Hollman: We see the greatest fuel economy decrease in your newer vehicles. What's happening there is on your newer vehicles that have oxygen sensors and computer controls, it sees that oxygen in the fuel, it senses that it's also running leaner than it is meant to, riches up the mixture, which cause you to increase the amount of fuel consumed. And even on your newer vehicles, we've seen some as great as seven percent for that technology. But it's that closed loop technology that is likely to see the biggest hit on fuel economy.

MLT: ???

Hollman: And we do the fuel economy testing when we run our FTP test, the Federal Test Procedure, where we're mainly going after emissions data but it's the exact same test that EPA runs on the new cars' window stickers for fuel economy calculation. That's the test that's run so...

MLT: Do you run that on every car?

Hollman: No, just representative sample cars. That test is conducted under very controlled conditions, for temperature, humidity, driving cycle. It takes a day prep time. It only takes twenty minutes to run but it's following a prescribed cycle.

In a private lab, it would be about one thousand dollars per vehicle to do that test so we don't do that for all the vehicles out there. But over the years, starting back in 1983, we take what is a representative sample of vehicles on the road and test them and see what the change in emissions in the fuel economy is and do get that data available.

(pause) You mentioned something, were you interested in small engines, do you have a lot of small... weed wackers... two cycle jet skis or something... or are you covered on that? Bob Reynolds has done a lot of work on that, so he's had a lot of that compiled. We had some concern on that when the program first started. The biggest concern was expressed. We have a wintertime program so snowmobiles which take people to very remote locations that you want to get out of very bad, badly in the high country. So there was concern. How we advised people first was to check your owner's manual. If the owner's manual recommends against ethanol blends, don't use it. There again, it goes back to the choice of oxygenates using MTBE blends. We recommend that people try the snowmobile on the MTBE blend before they go into bad country and make sure that it's tuned for

that fuel. It's possible those are very high revving, high performance engines. Maybe it would need some adjustments to the carburetor or carburetor rejetting to run properly. We didn't see a large problem with that. We had a couple of calls, a little, just a couple.

We never heard of any situation where a person was stranded because of the fuel and attempt to hike out or something like that. And of course, you'd have different but you may have small engines. And just good advice on that. There is some literature available. Probably the best advice is check your owner's manual, check your local dealer where you get the vehicle serviced and follow their advice.

MLT: Speaking of the dealers, what kind of information should we get to them?

Hollman: Good information... hehe... sooner better than later. The dealers, automakers are a very important group to reach. A lot of times people won't believe their mechanic. You know, they're always suspicious they're having repairs they won't need. But if the government's mandating a fuel, and you're putting out one word on it and your mechanic says something different, they're probably believe the mechanic before they will the government. So it's important to reach that group and give them good information on the ethanol blends. There's some manuals put out catering just for that group, putting it in trade-talk.

Also, I think it's important for auto dealerships to know, make sure they know even what the manufacturer do. General Motors, for instance now, and has for several years, recommends that you use oxygenated fuels. They say the vehicles are compatible with it, it's good for air quality, and they think it's good policy. However, if you go into a GM garage, the mechanic might say, “No, you can't use it. It'll void your warranty." So make sure they know even what the manufacturer says. And the manufacturer always has the final word on that, not the local mechanic.

But we put on workshops here. We would bring in anywhere from thirty to fifty mechanics and had a speaker. A (???) person had hired them once. He trained the trainers. We had earlier workshops where we had a professional in the area of oxygenated gasoline bring in vocational education teachers, shop teachers, train them and then they'd put on further workshops for the mechanics, your service reps, some key people like that. We think that went a long way to getting some good information out there.

If we were to do anything different, I think we would've done that earlier and done more of it.

“We put on workshops. We would bring in anywhere from thirty to fifty mechanics ... we think that went a long way to getting some good information out there.”

“If we were to do anything different, I think we would've done that earlier and done more of it.”

MLT: So how much did all that program cost? In order to set it up... (indecipherable)

Hollman: The person, that's what we did at the time, the gentleman we hired was Bob Reynolds. The name of his company at the time was, I believe it's still, Downstream Alternatives. And he would come and do workshops. It wasn't something he did special for us. He was already in the business of doing that. I can't recall the cost on that. I do recall it wasn't cheap, but is was very much worth it. And there again, we would contact our vocational educators and then have them train them and then try to fan

out, network out from there. For the vocational teachers, to train other teachers and then classroom students.

MLT: So how many of the workshops did you think you actually...

Hollman: Serving from memory, there again, that's going back eight years, I recall at least a thousand people going through that. We had a dozen or so at these workshops and we held them at different locations along the oxygenated fuel area, so from Fort Collins, Denver metro area, down to Colorado Springs. So they were well received. We had a good turnout.

MLT: ...total.. at least a thousand

Hollman: How far we networked out from there? As far as...

MLT: ... out of how many vehicle repair shops we have... you know...

Hollman: I'm not sure (laugh)

MLT: ... on that... I think it was about 500... certified auto technicians... or something like that.

Hollman: We went through the community colleges, the ASE, Automotive Service Excellence, try to get some of the mechanics certified through there. And also we train mechanics through our vehicle emissions inspection program. So we use that list and just did a mailing. I noticed several thousand mechanics to contact them with, you know, flyers and where one of these workshops were. Also, there again, the manual that Downstream Alternatives put out. We bought a thousands and thousands of those, and had them readily available for people attending the workshops, take with them, take a couple extras copies for their buddies back at the shop. And also, like say we licensed the emissions mechanic and for several years following the first year of the program we had stacks of these out for people who had to come in re-certified for that program, and if those were mechanics, they could take that with them.

MLT: (indecipherable)

Hollman: Oh, uhuh. We find that real useful.

MLT: (pause) OK...

Hollman: Are you going to be enforcing this program? In other words, do you want to talk about that, how we enforced the program, go through that? We also enforce the program at the retail as well as upstream facilities, refineries, terminals, blending facilities. And what we do is we have inspectors that go out and pick up a sample of gasoline. (Probably against every fire code.) But we use glass bottles. Our chemist tells us this is the best way to insure the integrity of the sample. You don't have any metal contamination that you might with a metal can. This is an approximate, I believe an eight-once bottle. We fill it up right to the lip here, have a special lid that will seal the vapors and is compatible with gasoline. We get one grade of the sample at the station so usually three grades per retail site. We have a tracking code we assign to the sample number and then have an inspection form filled out that identifies the station that it's taken from. We attempt to get that dropped off to the lab each day. And then, they have a five day maximum turn-around time on those samples. They get back with us and let us know whether it had a sufficient amount of oxygenate in there. Those that don't then, get scheduled for what we call a notice of violation hearing, where our enforcement officer will have a hearing. They can bring in any evidence, why they think our sampling was off, our analysis was off, if they have any other information on shipments or anything that would tend to refute what we saw. When we're out sampling, if they want to split sample, we could draw them

another sample, leave a bottle with them. They can send them to their own lab and see what kind of results they get from it. We do a lot of quality assurance with our instruments. We run a pretty tight tolerance on it. And so we've had good sampling over the years.

MLT: ??? certify the ???

Hollman: How do we do it in this state, I know other oxygenate programs are different. We pick up the samples and then we contract with that agency that's doing all the other gasoline analysis, that calibrates the pumps, check for octane, all the ASTM specifications. I know other states have a contractor to give them that duty directly to that agency. So, in this state, since we're in charge of running the regulation, we wanted to insure the integrity of the sample. So we simply contract with them for the analysis. So there's the analysis. So there's really not a right or wrong way to do it, just what works. And in the future, it could turn out maybe they would be picking up the samples as well. But to this point. And how we're doing it this year is we're just hiring part-time staff to go out and pick up the samples. So it's a pretty simple procedure. So this year we're going to be hiring a retired state employee or someone doing part-time work like that. So that works out well for both parties (?). On all this, at least for our program oxygenate fuel program, it's not an overly staffed program, and we joke it's seasonal work. You know, we run it during the four months of the year maybe yours, it would be year round. But we simply pick up the samples, analyze them, take enforcement action on the noncompliant samples, write a report at the end of the program what happened, and then don't do anything until we've ??? the fall after. You're simply ramping up for it again. So it's a fairly cost-effective program to run.

MLT: OK. (pause) (discussion in background - “we also have a vehicle emissions testing program”)

How do you pick them? Do you go out, grab somebody and say, “We want your vehicle in here now?”

Hollman: Indirectly, through the mail, we do that. What we do, when we do emissions testing, we contact our Department of Motor Vehicles and get a printout of the registration list for all the vehicles in the area. Then we work with a statistician and get a randomized list, a true random sample, of different vehicle age groups and technology groups we're looking for. Then we send out letters to the people from each of those. We will offer a rental car, sometimes a savings bond, trade 'em cars for a week. And so we get enough people volunteering for that to get a representative sample. We try to make it a randomized sample but (?) out for some of the selection that occurs for people basically volunteering (?). So we feel it does represent Denver's population at the time when we do a study.

MLT: It's kind of sending your car for jury duty...

Hollman: It is. A lot of people are more than happy to trade for a new rental car than the other people who don't want to but we've always been able to find enough vehicles. We have a procurement person that works just when we're going through one of that. So it is fairly involved. We have some correspondence back and forth making sure we're getting the right kind of vehicle, making sure it accommodates taking the kids to brownies and getting to work and all the other activities the people are involved in. It takes some time to do it.

MLT: You must have ??? some really good ??? for that.

Hollman: Yeah. we do. It's good enough to uphold the program all these years. (laugh)

Creamer: Our refinery, Conoco's refinery, and the refinery across the street are relatively small as far as refineries across the nation go. Conoco's is larger than Total's. We have about fifty thousand barrels per day production at Conoco's factory. Total's refinery produces about 32,500, something like that.

MLT: That's a pretty good size. I think Chevron's about 50,000. PRI is about 99,000.

Creamer: Of course, many of the Gulf Coast refineries are 150 to 250 thousand...

MLT: At what point do you add the ethanol?

Creamer: It's added at the distribution truck loading facility and it is injected as the product goes into the tanker and is added in a proportional basis. So that, if you want to sample the product at any given time in the line you should get a representative sample of what's going into the truck. Now that's not the way the system was originally set up to operate. It was originally set up to operate such that you were sure that you had the right quantity in the truck at the end of the loading period.

MLT: A sequential loading system?

Creamer: Right, not on a proportional basis.

MLT: So the driver enters the wrong capacity for the truck, you'll wind up with some weird mixture.

Creamer: You might or... The real problem is being able to sample a representative sample. And to do that, you have to get up on the truck and sample out of the truck at the end of the process which we don't like to do because there's some safety hazards built into that. It's better if you can get a line sample if it's on a proportional basis.

MLT: Would it be possible for us to go to the terminal and see what it's like...

Creamer: I can't do it on a short term basis - and if you're just gonna be here shortly, you know I have to get some approval, so forth to be able to do that. I know that Ted told me last week. I was gone last week but he left a message and said you might want to take a refinery tour and I could probably arrange that if you had a little bit of time to spend with us and if you said for sure you wanted to that this week then I probably could have arranged it this week. But on a short term basis, it's probably not gonna be able to do that.

MLT: Yeah, I'm leaving Tuesday at 2 pm.

Creamer: Tuesday... we might be able to arrange something before Tuesday if you like.

MLT: I'd like to see the blending at the terminal. One of our terminals did have, I think, for a short term in 1986. They bought certain quantities of ethanol. So they had a tank and they had a little dispenser and I think the trucks drove over and they put the ethanol in and they drove over to the other part with the gasoline but the whole system was changed and they removed those tanks...

Creamer: Well, used to be that companies' distribution facilities would do what is called splash burning - just add ethanol on top off gasoline and let it mix as it is driven to the destination. But there were some problems with it. First of all, in terms of mixing and secondly, in terms of getting more ethanol than what was desired. We had some bad experiences with ethanol blending back in the early eighties. We weren't required to have ethanol but ethanol was cheap then. It was cheaper than gasoline so people were extended their gasoline supply with ethanol. And in doing that, they wound up with twenty percent concentration ethanol in the product in the mid summer. And we had a lot of problem with vapor locking. And people got a bad taste in their mouth for ethanol blending at that time which kind of carried over the first beginning of the ethanol... (click) or oxygenate fuels program and there were some thi... hurdles to get over with. And after, people started to use the ethanol product and knew it was blended properly and wasn't going to do damage to their automobiles. Then they began to accept it.

MLT: So did you run into some technical problems like compatibility with tanks?

Creamer: No. You really don't have any problems with ethanol. Carbon steel. If you're just, if you're just gonna store neat ethanol. That carbon steel is adequate to do that. You need to have the ability to keep water out of the system, of course. If you've got a fixed roof tank, the heat vapor pressure of ethanol is about three and a half pounds. It's got some denaturant in it which changes the vapor pressure a little bit. Usually, that denaturant is gasoline. But it may be low enough vapor pressure that you can get by with a fixed roof tank and... as opposed to a floating roof tank.

Creamer: No. You really don't have any problems with ethanol.

"Did you run into problems like compatibility with tanks?"

"No. You really don't have any problems with ethanol."

MLT: How about the retail stations? What kind of preparations would they make? What kind of things could they have to...

Creamer: We hired ADM actually to, because we were buying products from them, to service ours, our Conoco stations to be sure water was out of the tanks and before the season began. You kind of had to do that on a seasonal basis. You know, if you're flip-flopping back and forth, if you're gonna blend ethanol year round then it's probably not a problem. But if you're flip-flopping back and forth between an oxygenate and non-oxygenate then it's important to be sure that you got water out of the system at the beginning of each season. And... using, using water paste to be sure you got the tanks dry. That kind of thing, standard operating procedure just to be sure that you got the tanks completely dry.

MLT: How about adding filters or changing fuel?

Creamer: Yeah, filters are very important in regard to the ethanol blending in to keep both water, any water, that may be in the system out as well as any rust particles out. Sometimes when people have not used ethanol in their fuel systems in automobiles, particularly in the older automobiles, is that you build up some paste or layer in the bottom of the tank. Ethanol is a pretty good solvent and it'll remove that and so what we did when we first started to sell ethanol blending was to offer, I think , it was two free fuel filters to the customer should he have any problems with plugging of fuel on his automobile and we didn't really experience that many problems but the possibility exists for

that to happen. So the customer has to be aware he could have these problems, fuel filter plugging particularly.

MLT: So are some of your stations now going through some preparation processes?

Creamer: Well, yeah. Those, you know, wet water paste. We check out the tanks that need to be vacuumed out or if we need to remove water from the tanks, we do that.

MLT: Would it be possible to take a look at that?

Creamer: I'd have to talk with our marketing department. That's a different arm of Conoco than the refinery. Actually our distribution system at the refinery is operated by our transportation department so we have refinery department, we have transportation department that's loading the product out to marketing and marketing folks take it from there and so we'll have to contact somebody in marketing to be able to get you in touch with the service station folks.

MLT: Yeah, that could be good to hear. Some people are concerned some of the old stations may not be compatible. Are these guidelines for what type of tanks?

Creamer: Well. Colorado now has an underground storage tank program where tanks now have to be double-lined tanks and so in the last three to four years, virtually all of the service stations in Colorado have had to have upgraded tanks and in doing that then, because we're into the oxygenated fuels blending that we take a look at what tanks may be compatible and what may not be. Most tanks are compatible, you know, the plastic type tanks are compatible. It's just that you have to be concerned with the with any glues or that kind of material that have been used to hold together the tanks if there are any. And so you have to be sure that the ethanol is not gonna dissolve that kind of thing.

MLT: How would you check if somebody had got a service station ??? and an old one had been used. Is there anyway to check?

Creamer: If you know who the manufacturer of the tank was, perhaps you could do that. But it may be difficult to do that. Most of the older tanks were carbon steel tanks. They weren't double-lined tanks. Because of some problems that had existed in making underground storage tanks, the EPA has the underground storage tank regulations which dictate changing those tanks now. I think it may be difficult to determine that. I don't know whether Hawaii is under the EPA regulations for underground storage tank ?

But I suspect they might because the issue there really was contamination of ground water, contamination of sewers, contamination of wells, that kind of thing. So I would suspicion that may be Hawaii has that kind of program as well in which case you'll be able to determine, probably who the manufacturer of those tanks were and whether they're capable with ethanol blending.

MLT:

Creamer: I don't know. We'd have to check with the marketers again because they're the people who are responsible for ensuring the compatibility of the service stations. That would be a concern that you have to check out. Now you're dealing with ten percent ethanol blends as opposed to alcohol. So the ability of the ethanol to degrade the tank probably would not be as great as the alcohol but it would be something that needs to be checked out.

MLT: Do you know of any guidelines...

Creamer: API has some guidelines. I don't have any access to those. Our mechanical engineers that are involved in designing service stations would be the people we'd have to check with in that regard. The State also would have some information in the regard I think because EPA dictates the State this program has to take place and then the State takes it from there to insure those tanks have been changed out so the Oil Inspector's Office probably, in the State of Colorado, is probably somebody you could check with... The guy's name is, the head of that department is Nick Pifou (?).

MLT: Is that with a P?

Creamer: Yah, P. Let's see if I can find his telephone number... His number is 289-5643. You might give him a call and he's got a lady who works for him by then name of Lois Struck. If he's not there...

Interview with Patty Stulp
President, Ethanol Management Company

Thursday, October 13, 1994

Stulp: EMC has a blending terminal where we bring in different octane gasolines and add it to ethanol. The part that is significant in the way our terminal operates is that we truly have quality control from A to Z.

The blending is controlled by a computer. We keep track of what goes into each compartment in the truck. Before the computer will allow the manifest to be printed, it checks each blend to make sure it's at it's appropriate percentages. We make products that go from 85 octane, which is our base octane here, to 93. The difference being the kind of additive and the octane. So that when a customer comes in, they can pick a gasoline slate that looks like the gasoline slate they're used to. The difference being that it's oxygenated and reduces emissions.

In fact, with one company, that's their advertising campaign. That they have reduced emissions for the same low price. And it's turned out to be very effective. Their gasoline actually meets the reformulated gasoline standards that are going to be imposed next year, now. Even though Colorado's not even a reformulated gasoline state.

MLT: Who's that?

Stulp: Coastal.

MLT: Coastal? Do they do it all year long?

Stulp: Year round.

The slogan for their fuel is "Next Generation." And their advertising campaign was great. It's a... they did a man on the street kind of interviewing, "If you could design the next generation of fuel, what would you have it be?" And the three things were: work well in my car, affordable, and environmentally friendly. Better than what we got. And so that's what they're going to do.

MLT: Let's say we would want to start putting ethanol into gasoline and were going to construct ethanol storage and blending facilities. How much... what's involved in this?

Stulp: Let's start at the last and talk about what the retail station has to do. At the retail level, it's really housekeeping. Ethanol mixes with gasoline and stays in solution great. Gasoline and water don't mix. They never have and probably never will. The problem with an ethanol blend that we have to be aware of is that when the ethanol gasoline is exposed to free water, the ethanol will go with the water. The way to prevent that from happening is to keep the free water out of the bottom of the gasoline tank. We tell our customers, what we've done for the last five years, if there's free water, meaning they can detect it with the water finder paste, to pump it out.

MLT: So let's say that you have that paste and you put it in the tank.

Stulp: Water's heavier than gasoline so it's going to be at the bottom of the tank. You take a stick and it has to go all the way to the bottom. The paste really only needs to be at the bottom of the stick because that's where the water's at. If you can detect water in there, pump it out. The thing that makes that different now than it used to be is that now it's a toxic hazardous waste so it's harder to deal with it.

MLT: How do you dispose of it?

Stulp: A hazardous waste company. They have to pay them twenty-five cents a gallon. That's why most retail stations, that isn't a problem for them anymore because they've long since dealt with it because of the new EPA rules.

MLT: Yeah.

Stulp: You pump the water out. I have always said get your tank dry. It wasn't until I'd been in this business about two or three years I figured out, you can't get it absolutely dry. You have to get out everything you can pump out. If you get there, there'll be about a quarter of an inch left. That's not going to be a problem. Ethanol blends actually act like a big can of heat. It's not going to be an issue to you but it's a big one for us out here. It'll keep your system very dry once you get it in there. You start out with a dry tank.

The other key thing is a filter. We in the ethanol industry used to print up brochures and hand them to people. It'd say ethanol's some wonderful stuff. You're going to put it in your car (noise) and it'll probably plug your fuel filter up but that just means it's cleaning your car and it's worth its stuff.

Well, it turns out, we don't have any cars that's been sitting around for fifteen years with gasoline and without moving. What we have are a lot of storage tanks at retail stations that have been sitting around for fifteen years and that's where the build-up was. The ethanol blend was cleaning out the tank, washing it into the customer's car and plugging their fuel filter. We found that if you put a fuel filter on the tank, if it's going to clean out your tank, it'll plug that filter, you replace it and it never gets into the customer's car. Since we've done that, customer-car-fuel-filter-plugging is not an issue. But I strongly recommend that people put a filter on. I go so far as to recommend the kind of filter.

"We in the ethanol industry used to print up brochures (that said) ethanol's some wonderful stuff. You're going to put it in your car and it'll probably plug your fuel filter up but that just means it's cleaning your car..."

Well, it turns out, we don't have any cars that have been sitting around for fifteen years with gasoline and without moving. What we have are a lot of storage tanks at retail stations that have been sitting around for fifteen years and that's where the build-up was ... if you put a fuel filter on the (service station) tank, customer-car-fuel-filter-plugging is not an issue."

MLT: Oh...

Stulp: There are filters out there that are called hydrosorb filters. I like Cim-tek filters because they have corn starch in them. What happens is that if you get water at the bottom of the tank and it would get somehow pumped up to the nozzle the corn starch swells up, plugs the filter, and it can't go into the customer's car. It's like one last final insurance policy. Wits (?) makes a hydrosorb filter. We found that if you start with a dry system, it's going to stay dry. And so, there are a lot of people, I have to be really honest, who don't use hydrosorb filters anymore. I think it's an extra insurance policy and it's an insurance policy against somebody making his delivery, leaving the fuel cap off and rainwater running in. It's not going to be water from the system that will get you to start out with a dry system, it's outside water. You guys don't share our problem when snow melts and then running off but I think you do have rain (click noise). At the station, that's all you have too do: get the water out, put the fuel filter on.

MLT: Do you have a spare filter to see what it looks like?

Stulp: You know, I'm not sure if I have a filter. I have an adapter. These are filters that are literally spinned on. They look like an old oil filter, spin-on. This is an adapter we use, we have a lot of older dispensers around here that did not come with filters. The dispenser would have a little screen in it but that, that won't do it. We're talking about really small particles, that would get, varnish, lacquer, cleaned off the tank. So we need a tight paper filter. This adapter literally just, the hose comes in one end, the hose with the nozzle out the other and you put a filter in between. So then we had to put a lot of these on the stations that didn't have the filter. Most of all the filter suppliers have an index. Tell them what kind of dispenser you have and, and they can do it.

The hydrosorb filters are like two, three dollars more than a regular paper filter. But I highly recommend it. The ethanol and water issue is one that people have talked about forever because ethanol likes water so much. It's not a problem if you deal with it up front. It's a problem if you don't deal with it, if you put ethanol blend into a wet system. Then instead of having this two to three inches of water at the bottom ... all of a sudden now ten percent of your product is at the bottom. And that will get into the customer's car. So start with a dry system, put a filter on and that's it for the retail station.

"The ethanol and water issue is one that people have talked about forever ... It's not a problem if you deal with it up front. It's a problem if you don't deal with it."

"So start with a dry system, put a filter on and that's it for the retail station."

Ethanol's affinity for water is the reason why we can't pipeline it like you do gasoline. The entire gasoline distribution is set up in the lower forty-eight or whatever you guys call it, we have all these

pipelines. And they have low spots in them for the water to accumulate which works fine if you're transporting gasoline. It doesn't work fine if you're doing an ethanol blend. You put it in the pipeline and get a low spot, the ethanol is going to stay. So we don't use any of the normal petroleum distribution pipeline to move ethanol. If you're storing straight ethanol, and that's what we've done in our terminal for ten years now, seven years now. We use the same stuff we use for gasoline. We use carbon steel, viton gaskets, which is what I would recommend. It's also what I would recommend for today's gasoline. That's about the only change they that we've seen, you know which is much lower in cost. But the aromatic content of today's gasoline pretty much dictates that we use viton.

Now I'm going to do an MTBE thing for a minute. MTBE is exactly the opposite. MTBE hates viton and will destroy it.

MLT: Really? So what's, is there something that's compatible with everything?

Stulp: No. What Bunol (?) which ethanol and gasoline work with that's not long-lasting, I mean you have to do more regular replacements, will tolerate MTBE. Viton which lasts much longer with gasoline and ethanol will not tolerate MTBE. (to secretary) OK.

Thanks. (back to MLT) So, our system with our terminal, we actually are still in the experimental stage, trying to find something that will work for both. Now, bear in mind, I'm talking about the straight product. Once they get blended with gasoline, they're just fine. But when you're handling the neat MTBE, you need ethanol. You need to be aware that MTBE destroys viton. We ruined the diaphragms in our meters with less than two thousand gallons. And that's clank, clank, clank and it was over. But we have a, it's almost a plastic-type product that one of the meter companies came up with that seems to work for both. Bunol (?) works. It's just that we have to replace the diaphragms more often than we would if it were viton. But that's something we didn't know when first started handling both products and storing very quickly.

Let's talk a little about blending ethanol and gasoline together. As I said earlier, they mix very nicely and stay in solution but they have to be mixed. There's enough of a difference in the specific gravity... The thing... I wish I had cream, but you take a clear glass and put coffee in it and just dribble milk into it, it'll stay milk. Once you stir it up then it doesn't separate and become milk. Gasoline and ethanol work exactly like that. You mix them together and there needs to be movement. The petroleum industry always makes fun of us because the best way in the world is to put it in a tank and stop at a stoplight. It truly is effective. Once you hit two stoplights, it's mixed and it stays mixed. But they have a way of saying stoplight blending like it's just yuck. But it'll work. So you have to do that. We tried a couple of mai... we tried adding the ethanol separately at the station. Those kind of things, they don't work. They need to be mixed and there has to be agitation. But once you go through those stops, it's just like the coffee and cream. It will stay mixed.

MLT: So how does your... do you guys do sequential blending? So how does it get mixed in there?

Stulp: The truck stops.

MLT: Oh, OK.

Stulp: We pump at four to six hundred gallons a minute. And you would think, pump bottom loading, that that would be enough agitation. But we've actually stopped the truck on the rack, sequentially blended into it and could not get a homogeneous sample out of it. But once the truck stopped at the gate, stopped at the railroad tracks and got down to here, it's blended. So you got to do it.

MLT: So, um... Let's say some folks are wondering if they should get the... the type of system you got, with the sequential loading or what do you call, proportional loading. What are the differences in cost...

Stulp: Costwise, they're becoming much closer. It used to be that in-line blending or proportional blending was much more expensive because you had to have more. We do all of ours through one meter. And with in-line blending, when you're doing six components like we are, then you would have to have six meters. The technology has changed. Things cost less. Right now, it wouldn't be that much different.

If I were to put in another system, I would probably do a combination of the two. I like sequential because ethanol is by two and a half times the most expensive product out there. And the way we blend, we preserve the integrity of the ethanol all the way through. In an in-line or proportional blending kind of thing, if there's an error, you lose control what your percentage of ethanol is. And it's really an economics-driven thing with me. I mean, I want to make sure I know where that ten percent ethanol is and, if something happens, then we can go back and manually blend it to be right and we don't lose the ethanol.

MLT: OK. You mentioned that there are guidelines like API or what was it, ADM or somebody had put together a checklist of when you're converting your station to dispense ethanol blends.

Stulp: Yeah. This is a great book. On page 18, 19... 20 and 21, it has the conversion of service station tanks to ethanol blends. And they're very good. And this is great. It points out one other thing on the water finder paste. Once you convert to an ethanol blend, you need to get a water finder paste that works with an ethanol blend.

My only experience has been with Sargell. I don't work for Sargell. They don't give away caps but their paste works great. I have looked at some other people's and it hasn't been as effective. What happens is if you don't use a water finder paste that knows about ethanol blends, the ethanol will mask the water. So you could actually have water in your tank but it'll come out showing no water or I've seen it when it comes out and shows you there's water all the way through the tank because it thinks the ethanol's water. Sargell doesn't do that. Sargell truly can distinguish water and gasoline.

MLT: How do you spell that?

Stulp: S-a-r-g-e-l-l. Before you get into ethanol blends, the water finder paste you're using now is fine. It's only after you've introduced the ethanol blends that you should go to Sargell.

MLT: Ok.

Stulp: This book is great. It has the firefighter procedures. Ethanol blends are handled the same as gasoline. It moves as gasoline. The firefighting procedures... everything's the same as gasoline. When you go to straight ethanol, it's different. That's why our fire detection system at the terminal goes both heat and light. Ethanol burns clear. I mean truly if it's pure ethanol, you can't see the flame. So you have to have a heat detection system in... and the five percent denaturant really helps because it puts a little orange peak on the flames. But there's a different foam that you use for straight ethanol than you would use for gasoline. But once again, once it gets blended with gasoline, you treat it like gasoline across the board.

"Ethanol blends are handled the same as gasoline. It moves as gasoline. The firefighting procedures... everything's the same as gasoline."

That's where the ten percent blend came from. The Nebraska Gasohol Commission's the one that designed it and they wanted to use ethanol. They would be happy if you used one hundred percent ethanol. So their goal was to find out what was the most ethanol you could put ... and act like gasoline. And that's where the ninety-ten blend came from. In every way...it still acts like gasoline. When Brazil converted to ethanol, they did twenty-two percent. And amazingly enough, their General Motors, Volkswagen cars ran just fine. But now, they use a lot of straight ethanol.

Interview with Kim Livo

Environmental Protection Specialist, Mobile Sources Program
Air Pollution Control Division, Colorado Department of Health

Tuesday, October 11, 1994

MLT: What type of things do you guys actually do here?

Livo: Ok, our unit here deals with fuels and fuel quality issues in terms of air pollution. We also deal with diesel emissions, alternative fuels, so forth. One of the big components for our unit is the oxygenated gasoline program which includes ethanol as well as MTBE blends.

MLT: Ok, well. Let me go get the ??? papers. I'm going to ask you if this is true or not true. (reading) "Quality control. Ethanol has a very strong affinity for water and is not readily admissible in gasoline. Simply stated, ethanol attracts water and does not like to mix with gasoline. This presents many handling and storage problems in bulk tankage to pipelines to storage tanking to service station tankage to the actual vehicle fuel tank. Intrusion of water at any point in the delivery system will contaminate the fuel, causing severe vehicle performance problems."

Livo: Well, the answer I have to a question like that is that: number one-water is a problem in gasoline. Gasoline and water do not mix also. Water will drop out of the tank, settle on the bottom of the tank.

If there's too much water in regular gasoline in an underground storage tank, the intake tube which is a couple of inches off the bottom will get the water instead of gasoline so good housekeeping practices at service stations are always important no matter what gasoline you use. Ethanol blended gasoline, there is a little more affinity for water with ethanol. And that water level in an underground tank will grow because ethanol leaving gasoline going into the water segment. So it's important to watch the water level that's present in tanks, such as an underground storage tank at a gas station. But it's always important to watch that. So it's no different to what you should be doing to maintain good housekeeping. And in Colorado, we're a dry state now but we've never really experienced problems where the ethanol was enough to create the problem. If there was, it was always there with the water to start with.

"It's important to watch the water level that's present in underground tanks... But it's always important to watch that. So it's no different to what you should be doing to maintain good housekeeping."

"Water ... is a problem of water. It's not a question of ethanol in gasoline."

MLT: Um... it also says, "contaminated fuels will have to be ??? potential ??? reliable ???

Livo: Right, right. All they're saying there is that if you get water into gasoline then the ethanol will drop out and the fact of the matter is the way the blending is conducted today, the ethanol is added to gasoline by an in-line blending unit before it goes into the truck. There shouldn't be a problem. We've never seen a problem there. The gasoline quality, if it's quality gasoline to start with, it'll continue to be quality gasoline down the road.

MLT: Do you ever have humid days, where you have thunderstorms, water flying all over the place. Does that cause problems?

Livo: We do really get some gully washers in the spring. And of course, once again, a gas station should be designed to be a little resistant to surface run-off of water. And the problems we've always seen in Colorado, and there haven't been very many, is that water entering the gasoline tank from surface run-off, whatever, is a problem of water. It's not a question of ethanol in gasoline. If there's too much water coming into the gasoline tank, once again it will interfere with the quality of the gasoline going into the car regardless if there's ethanol or not in it.

MLT: They made the statement that over time, ethanol blend fuels will tend to separate in vehicle tanks. Free ethanol will absorb the dense moisture and create significant performance problems.

Livo: That's a good question but I don't think it's very relevant. When you use an ethanol blended gasoline and you're using it repeatedly, the ethanol will take in any small amount of excess water in the fuel tank. It'll go through the engine, be burned up basically, and spit out the tailpipe. Once the water is gone from the fuel tank, the ethanol or gasoline will keep that tank perfectly dry so there won't be a situation where it has the ability to separate out.

MLT: Did you ever have an ethanol fuel separate in vehicle tanks?

Livo: No.

MLT: Not at all?

Livo: Not at all. Not one complaint.

MLT: And you have used ethanol blends in the summer as well?

Livo: Yes. Ethanol is sold in Colorado on a year round basis. Now, it's mandatory in the winter; we have the highest amount of usage in the winter. But there's a small but significant share of the market year round. And no, we don't have any problems with our ethanol in the summer or in the winter.

MLT: Ok. Environmental quality.

Livo: Ok.

MLT: (reading) “For those concerned about environmental quality: Ethanol is not a desirable fuel choice.”

Livo: Not true. Actually, we were the first state to look at the use of oxygenated gasoline strictly for the air quality reasons. And oxygenated gasoline includes ethanol blends.

We found that oxygenates do tend to reduce carbon monoxide emissions. So they're very good in areas where there are carbon monoxide emissions. They also help to more completely burn up hydrocarbon emissions out of the tailpipe. So a vehicle using ethanol blends will have lower carbon

monoxide emissions as well as lower tailpipe hydrocarbon emissions. You also have lower toxic emissions like benzene. You do have certain trade-offs though. You will increase your acetaldehydes slightly. And you increase NOx somewhat as well as perhaps evaporative emissions if you don't watch for that. But to say that there's no environmental benefits to the use of ethanol is false.

MLT: Talking about the evaporative emissions. Hawaii is different. In Hawaii, overall vapor pressure with ethanol would be the same as overall pressure without. In that case, would you say that evaporative hydrocarbons were also reduced?

Livo: With the use of ethanol blended gasoline. If the RVP does not increase. If you hold the RVP steady, you'll minimize evaporative emissions increases. Since the midpoint of the gasoline distillation curve is still depressed somewhat through the use of ethanol, you will still get a small increase in evaporative emissions over regular gasoline. But most of those emissions will be ethanol, which is not a very reactive component in ozone formation. Additionally, because you have a significant portion of your gasoline containing ethanol, your evaporative emissions as a total will probably be less reactive than if you had just regular gasoline emissions.

So if your RVP is held constant, there is a chance that you're actually going to reduce the ozone potential of your hydrocarbon emissions.

MLT: Interesting. Yeah, I didn't even know that.

Livo: On the other hand, if you don't cap your RVP and just let it float with the ethanol in the blending you will have an increase in evaporative emissions. Most of those, that increase will be ethanol itself. So your average reactivity will go down but you'll have more hydrocarbons evaporating. So it's kind of a wash, whether you're going to have increased ozone because of that or similar amount of ozone. And nobody's really sure. It depends on what study you're looking at.

MLT: Ok... OK, they're saying here, (reading) "Ethanol also increases the final vapor pressure in the final product."

Livo: Ok, well, again gasoline is a soup ... The RVP (vapor pressure) of the gasoline is anything you want it to be. If you want a low RVP gasoline, you pull out the light hydrocarbons... And with the blending of ethanol, that doesn't change. If you want an RVP that's low, you just take in to account that ethanol is about an eighteen pound blending RVP and you adjust the overall mixture to compensate for that. So RVP is readily controllable with ethanol blends whether you want to do it or not. On the other hand, if you're adding ethanol on top of a finished gasoline, your RVP can increase somewhat half a pound to about a pound RVP.

"The RVP (vapor pressure) of the gasoline is anything you want it to be. If you want a low RVP gasoline, you pull out the light hydrocarbons... And with the blending of ethanol, that doesn't change. If you want an RVP that's low, you adjust the overall mixture to compensate for that."

"RVP is readily controllable with ethanol blends."

MLT: So if our base gasoline of about eleven?

Livo: Yeah. Right. If you have a base line gasoline of about eleven pounds, eleven pounds RVP, adding 10% ethanol on top of that, it's going to give you somewhere between eleven and a half to twelve and a half pound gasoline.

MLT: And then they go on to say, “ethanol increases final vapor pressure and product ...”

Livo: Right. I need to make this point that in Colorado, there have been a number of refiners and marketers who have actually blended base gasoline stocks for ethanol blending. So the base ethanol stock is usually a low RVP, a low octane gasoline. So it's an unfinished gasoline. So it's relatively cheap also. And blending ethanol into that just brings the gasoline up to spec. It'll bring the RVP up where you want it and it'll bring the octane up where you want it.

MLT: Ok, then they say, “this probably causes benzene emissions to increase.”

Livo: The use of ethanol in gasoline does not increase benzene. And I have to stress that. Ethanol actually dilutes the benzene content of gasoline which will lower the evaporative emissions of benzene and actually make the gasoline emissions less toxic. In addition, on top of that, benzene is a relatively un-evaporative type of hydrocarbon. It's difficult to evaporate benzene. So it naturally it doesn't want to evaporate anyway. But ethanol will actually reduce those emissions rather than increasing those emissions.

MLT: Yeah. Finally emissions of ethanol...(indecipherable)

Livo: Right. When you're adding ethanol to gasoline, there's several parameters you change. One of which is the reduction of benzene. In the Clean Air Act, toxic emissions from gasoline have to decline by fifteen percent in reformulated gasoline. Oxygenates such as ethanol are being used in reformulated gasoline to reduce the total toxicity of gasoline. The use of ethanol will cause a substantial decrease in the total toxicity of gasoline principally by the reducing of your benzene emissions. It also has a slight reduction in one-three butadiene emissions. The one toxin, however, it will increase is acetaldehydes. But taken altogether, if you're looking at all the toxic emissions from gasoline, your total toxic emissions should be substantially reduced.

“The use of ethanol in gasoline does not increase benzene ... The use of ethanol will cause a substantial decrease in the total toxicity of gasoline.”

MLT: Ok. The next one says, “vehicle emission of ethanol blends are significantly higher than gasohol compared to gasoline.”

Livo: I think when you're looking at emissions, you have to look at the circumstances. And you can blend gasoline in a variety of ways to minimize any emission. So taking that into consideration, if looking at ethanol, ethanol is a real good blending stock into gasoline for air quality. It's just that you have to be aware of the interactions it has with gasoline and the different emissions it causes. But if you're looking at total air quality such as carbon monoxide emission reduction, tailpipe hydrocarbon emission reduction, toxic air reduction, ethanol is a good blend. It's just you have to minimize your evaporative emissions.

MLT: Ok. (reading) “Other considerations. Ethanol does reduce fuel efficiency in vehicles by an estimated two to four percent thus magnifying the cost of consumption.”

Livo: We really looked at that because we were aware that there were reports that show fuel economy decreased with the use of ethanol blends. And what we've found, there are two factors going on. On the one hand, oxygenates, such as ethanol, tend to lean the air-to-fuel ratio out in our vehicles which tends to promote more complete combustion of the fuel, increasing the efficiency of the engine, giving you higher fuel economy. On the other hand, ethanol has lower Btu content than gasoline. So an ethanol blended gasoline has about a three percent lower Btu content than regular gasoline which would tend a say a decrease in fuel economy. We have an emissions control laboratory here in Denver that test cars. One of the things that we look at is fuel economy. We use the same test procedures the EPA uses to certify cars in Detroit for fuel economy. And that testing shows that for the newest cars here at higher altitudes there's about a one percent decrease when the two competing trends are taken together. At lower altitudes, it may be a little more. But it's important to remember that a typical driver cannot tell a two percent decrease in fuel economy. So the range of fuel effect that we're talking about is so small, that the average driver shouldn't be able to see it.

"Oxygenates, such as ethanol, tend to ... promote more complete combustion of the fuel, increasing the efficiency of the engine, giving you higher fuel economy. On the other hand, ethanol has lower Btu content than gasoline."

"We use the same test procedures the EPA uses to certify cars in Detroit for fuel economy. And that testing shows ... about a one percent decrease (in fuel economy) when the two competing trends are taken together."

MLT: Ok. By any chance, if they're doing any testing we could...

Livo: Right now?

MLT: Yeah.

Livo: We could phone.

MLT: Yeah? That would be great.

Livo: I don't think we have anything going right now but we could phone.

MLT: But if they did?

Livo: Yeah... OK?

Hollman: Ok, the phone number, very important, is 364-4135. And I don't know what the address is.

MLT: indecipherable

Livo: No... it's out towards the airport. Past the airport actually. Hey Ted? You got the address for those, Aurora test facilities? Martin, you got it? (searches) (talks to someone) Yah. They're going to have a car out there. They're probably going to come in before noon but they're not going to test before two.

Hollman: ...bring that up

MLT: Oh, OK. Go for it.

Livo: The one significant emission that ethanol usage may aggravate is the NOx emissions. And that's because you're leaning out the air to fuel ratio in the vehicle. You get the same effect in an inspection/maintenance program that tends to adjust the vehicle's proper combustion settings. The engine settings, I'm sorry. And so, the possible NOx increase you get with oxygenated gasolines is about on the same par as you get in a good inspection/maintenance program. It's either very negligible to a small increase. But that's the one increase that we've always been concerned about with the use of ethanol blends.

MLT: ??? possibly or the possibility of reducing total ozone formation ???

Livo: Well that depends a lot on your hydrocarbon-NOx ratios. And a lot of areas are limited by their NOx emissions. And so, in that situation, ozone formation may go up slightly. On the other hand, if you're limited with hydrocarbon emissions, you've controlled your RVP of the gasoline, so you're controlling the evaporative emissions. At that point your ozone, it should go down because your hydrocarbons are coming down. But it's dependent on the hydrocarbon-NOx ratio.

MLT: What if... ??

Livo: (laughs) Most areas don't.

MLT: Yah?

Livo: Yah. They're very few areas that really know they're limited with hydrocarbons to know what's going on. So, the basic tactic that the EPA has used for a number of years is the lower amount of hydrocarbons, the better and the lower the NOx emissions are, the better. And just go from there, basically. In Colorado, what we've looked at is that how bad is our ozone problem. And how much of an increase do you see in terms of NOx. And with an oxygenated gasoline, the answer for us at least, comes out of the fact that, number one, we don't have an ozone problem that's very big, if any at all. And number two, the NOx increase isn't very much, if any at all. And taking those two factors into account, we feel that there's not a significant risk to the use of ethanol in gasoline in Colorado.

MLT: As the use of ethanol has changed over the years, have you noticed any following increase in NOx at all?

Livo: Actually, what we've found is the cars are getting cleaner all the time and our ozone problem, a significant amount is due to the use of automobiles and trucks. And what we've found throughout the years, is that our ozone levels are being reduced. They are on a long term decline. It's a very shallow decline. But, but it's declining faster than the number of cars on the highway, declining faster than the growth in VMT (vehicle miles traveled). So it's a positive sign.

MLT: So in spite of increasing ethanol use in the summer...

Livo: Right.

MLT: You have seen a decrease in ozone levels?

Livo: Yes. We continue to see a decrease in the summer, even with the use of ethanol blended gasoline. And that's because cars are getting cleaner.

MLT: indecipherable

Livo: And I don't know if I gave you one of these. I don't know if you can focus... If we have it... Ahh, we don't have a very good one.

MLT: A graph of the ozone levels?

Livo: Yeah. We just have ozone exceedance days in this report. So it's... well, but needless to say it's decreasing. (swivels in chair) But I tell you what. I don't know if you can focus on this. (hands chart to MLT)

MLT: Oh!

Livo: That is the decline in the number of violations days in CO over... well, I don't know... it's, it's...

MLT: No, that's good. (puts chart on desk, camera moves to zoom)

Livo: Ok. What this represents here is the decrease in carbon monoxide violation days in Colorado and as you can see, in the early 1970s, we had over a hundred twenty days where the ambient concentrations of carbon monoxide exceeded the ninety parts per million standard. Through the use of the introduction of newer, cleaner cars with new emission control technology as well as the startup of our inspection/ maintenance program, the number of days decreased substantially through the seventies and into the eighties. Beginning in 1988 and at the end of this graph, we started our oxygenated gasoline program. The number of days continued to fall and it actually fell dramatically the first winter of our program. That decrease has continued to this day where last winter, we had one exceedance (background noise) of our carbon monoxide standard. So while this chart is several years out of date, it still gives the trend for our carbon monoxide violations.

MLT: So in 1986.. (points with pen) ...??? But in 1986, it was higher than in 1985. And in 1987, it's lower. Was that even without...

Livo: The part of that was that the oxygenated gasoline program. The winter of '87, '88 was the first winter when oxygenated gasolines appeared on the Denver market. So the 1987 numbers have an influence from the first winter's use of oxygenated gasolines. But it's the calendar year of 1988 when the program was really first in effect and you can see that the number decreased substantially from the '86-'87 period to the '88 period. And then, additionally, succeeding years the oxygen content of our program was increased up to the present level of 2.7%, oxygen by weight. That helped to continue the declining trend line down to the one violation level we've seen this winter.

MLT: Congratulations. (returns chart to Livo)

Livo: And also I have to point out, good meteorology plays a role sometimes. We're crossing our fingers this year. We may not have the one this winter, we may have two or three or four but in the long term...

Interview with Ronald Ragazzi
Environmental Protection Specialist IV, Mobile Sources Program
Air Pollution Control Division, Colorado Department of Health
Aurora Emissions Technical Center

Tuesday, October 11, 1994

Ragazzi: We're a mass emissions lab, we can replicate the full Federal Test Procedure, which is the test they have to use to certify cars that you are familiar with. That's really about the only test that anybody accepts that is valid for any kind of fuel economy and emissions numbers. So we're able

to do that here. And we do a lot of work with EPA for high altitude emissions compliance to see if cars meet standards at altitude. Since '84, they've been supposed to meet standards at altitude. But we're finding out even in 1992, a lot don't meet standards at altitude. So they have to recall those and repair them.

We're trying to do the best we can for our air quality here and that's just part of it. But we did use this facility for the ethanol testing. That time, we were calling it gasohol. And it was back in '83 when we did our first test on gasohol. And we also do alternative fuels. Of recent, we've done some M85 cars and we've also done one E-85 car. That's all. I mean, I think there's two in the state. We've tested one of them. I guess that's a pretty representative sample.

MLT: What effect does ethanol have on fuel economy? You test fuel economy too, right?

Ragazzi: The testing we've done up here with newer cars with about a ten percent ethanol mix shows about a one to three percent penalty in fuel economy. And you can do that under laboratory conditions. But I'm not sure if you or I driving on the street would ever...

MLT: Yeah.

Ragazzi: One advantage you got is that you got warm temperatures. You don't have the seasonal changes that we do.

Here, we tried to educate the public on what to expect when we went to our oxygenated fuel program and I don't know if Ted told you but we thought we covered all the bases with material compatibility and vapor lock issues and all these types of things. And what happened is we started our program when the temperature got cold. And all of a sudden, everybody decided to check their fuel economy. But a good part of it was due to the temperature changes. Where people come out in the morning, and they start their car up, warm it up, and end up in traffic. So all these factors, when you combine some snow and of course you got wheels spinning and you're not going anywhere.

MLT: Yeah. (laughs)

Ragazzi: We never thought about fuel economy and that was our biggest concern.

MLT: What's the... this is a little bit off the subject. But I've always wondered, what is the difference in fuel economy between this federal test procedure and normal driving.

Ragazzi: In real life.

MLT: Yeah.

Ragazzi: It's close. And that's all I can say is it's close.

MLT: Oh.

Ragazzi: The federal test procedure is made up of three parts. One is a cold start, after the vehicles have been shut off for at least three hours. So you start with a cold engine. Second part of the test is a stabilized warm engine. Then you shut off the vehicle for ten minutes and you start it to do the third phase of the test. So it's basically a hot restart. And we basically combine those three parts of the test and say, OK, this is the fuel economy and these are the emissions numbers. It's a composite. All I can say is it's close. If you had bought a car and expected to get 27.3 miles to the gallon because that's what it said on the federal test procedure, you might be disappointed. You'd

probably get somewhat less than that. Unless you're a very careful driver then why worry about that?

MLT: Depending on the driver too.

Ragazzi: Exactly, I mean, there are too many other variables coming in. All this is, is a standardized test, and this is the fuel economy on the standardized test. Whether it's the federal test procedure or the highway fuel economy test. The little car I've got typically on the highway gets much better mileage than it shows as far as EPA numbers go.

MLT: How about the effect of the ethanol blends on emissions?

Ragazzi: You can expect a reduction in CO. That's right across the board. We're seeing a ten to fifteen percent reduction with new vehicles. So we're seeing a reduction of carbon monoxide emission. I might say a reduction of total hydrocarbons is typically what we've seen.

And NOx goes either way. It's about a wash as far as I know it. An aldehyde issue may come up because you're oxygenating a fuel in excess of what it was originally designed for and things like that. If a car has an efficient catalytic converter on it, the actual aldehyde levels are very, very low. You're talking about milligrams per mile, very few milligrams. Probably in the neighborhood of ten to twelve milligrams per mile.

MLT: So is it possible to formulate your base gasoline in such a way so that the total aldehyde emission would not increase?

Ragazzi: I think its more the function of the car rather than the fuel. But I can't answer that question, I don't know. But then again, the work we did with newer cars showed a very small difference in aldehyde emissions between non-oxygenated fuel and 10% ethanol. As you get back to older cars with less efficient catalytic converters, you may see an increase in aldehydes. But here, an increase in aldehydes was well worth the reduction we got in CO. And we didn't ever approach any health hazards from the aldehydes. So we were all aware of that. EPA was well aware of it.

MLT: You tested...

Ragazzi: We tested it, we said we can live with it. So that was a trade-off that was made. But I think finally the converter efficiencies in newer cars are doing an excellent job of that. You have to look at that for published data on what your vehicles mix is.

Interview with Pat, Bill, and Kris Koster
Technicians and Service Manager, LittleJohn's Equipment Company

Thursday, October 18, 1994

MLT: What does PEI stand for?

Pat: Petroleum Equipment Institute... I'll make a copy of this.

MLT: Ok, thanks.

Bill: So, Pat: you...

Pat: You might as well sit.

Bill: Yeah (grunt) So what is it you want to know about?

MLT: Well, if we're going to avoid any problems when starting to use ethanol blends, we're going to have to know the right way to do it. It's kind of silly to start from scratch when you all completed... Hey, it doesn't seem to be working.

Bill: No, you shouldn't do that. It isn't the right time of morning.

MLT: Oh, I'm sorry.

Pat: Still hungover from last night.

MLT: You look fine.

Kris: Bill films real well.

MLT: And he's the one saying maybe we can get Kris to talk.

Kris: I'll talk. Bill films well. He has the photogenic face.

Bill: They don't want any old people. They want bright young people, Kris.

Pat: I gave her a copy of that thing Thomas did for us on suggested safety precautions when going to the job site required. That's about all I have. That and a list of pieces of plumbing pieces. And a list of PEI distributors in Hawaii. But her question was: How do you prepare the service station.

MLT: Yeah. Do you guys test for water and...

Kris: What I would suggest first in the tanks is that make sure you have a clean product to put in there. The problem with ethanol is if you put it in there and there's water in there. What it does is just escalates the problem. And you know, if you have a little bit of water and the alcohol tries to absorb that much more. So, the filter can't absorb that much water then what it's going to do is let it pass on through. You know, the tanks have to be cleaned right off the bat. No question about that.

> " The tanks have to be cleaned [water bottoms removed] right off the bat. No question about that."

MLT: Do you guys contract that kind of work? If the service station wanted to get someone to do the whole process of preparing their systems for ethanol blends, do you guys do that?

Kris: Well, we go out to test for water, stuff like that. But umm. Once, once there's found water, we usually hire another contractor to come and pump out the water and they dispose of it. Take care of it like that. Normally, once the ethanol's in there, there isn't too much of a problem unless you have water getting into the tank through outside sources like the filter cap not being put on tight

and you have water, rain, something like that. Or you have a leak in the upper part of the tank and it comes in through there, a fitting, something like that.

MLT: So, is it general housekeeping to test for water every once in a while whether or not you have ethanol in there?

Kris: You should test for water whether you're using an ethanol blend or not.

MLT: How often do they usually do it?

Kris: A lot of the stations have electronic tank counters. So that pretty well tests for water there. Normally, the stations just go out and stick, with a rubber stick. They use some sort of paste on the bottom. I don't know how often. It depends on the station I guess. They probably check more often in the summertime.

MLT: Is that once a month or something?

Kris: Nah, it's usually about once a week. Not a whole lot more.

MLT: So they should have a pretty good idea if they got water in there or not. And if it turns out they've got too much water and have to pump it out, how much is it going to cost?

Kris: Umm, I'm not sure, but the actual pumping of the water out isn't that much expensive. But now they've created a hazardous waste generator of water. So now it becomes an environmental issue to dispose of that water. Some of the ethanol companies would take some of that water and fuel and stuff back and they'll separate that water from the ethanol and fuel. Which is less expensive than having to drum it and dispose of it elsewhere. But uhh, water's a problem.

MLT: I guess the question I'm anticipating coming up is: how much is it going to cost a station to do what has to be done for them to able to sell ethanol blends.

Kris: Umm, as far as the tank equipment, there's no cost involved there. The only cost involved is at the dispenser when you screw on a monitor type of filter which looks at the amount of water and alcohol fuel which is dispensed through the filter. That ethanol takes a drop of water and puts like a coating around it and this'll pass through the filter with no problem. The problem with the filter has then is when you cannot coat enough of that water droplet and then water will get absorbed into the filter, swell up and stop the flow of fuel.

MLT: So how much do those filters cost?

Kris: Umm...

Pat: I think the price of those filters is twelve to fourteen dollars.

Kris: Yeah.

“How much is it going to cost a station to do what has to be done for them to able to sell ethanol blends?”

"as far as the tank equipment, there's no cost involved there. The only cost involved is at the dispenser when you screw on a monitor type of filter.. "

"..twelve to fourteen dollars."

MLT: Yeah? So most of the tanks are fine? I mean, are there certain types of tanks that have some kind of terne coating or something that can’t be used...?

Kris: Not that I know of. Pretty sure with the small percentages of ethanol like ten percent there's not a problem. When you start getting to higher concentrations of ethanol then you should definitely consult a tank manufacturer and see what they recommend.

MLT: So your ten percent ethanol blend can be pretty much used or stored in any existing gasoline tank?

Kris: That is correct.

MLT: Are you guys going to be testing for water or adding filters to anything today by any chance?

Kris: Not today. We got some stations coming up in the near future we're adding filters. Doing some for Texaco. Fill-ups right now. Everybody's starting to get their fuel in. It's just how fast when they load up the product and they start delivering it. By the first of the month, November 1, they should have that in the system.

MLT: Are there any stations that, you know, have the filter on that maybe we can go look at and...?

Kris: Umm, the problem is putting the filter on without the ethanol. For some reason, the filter does not like the straight gasoline. It's always looking for that ethanol to put that coating in there and kinda lets things go through. Use straight gasoline, the filter will clog that up because like I said, there's always a certain content of moisture. You know, it's not enough to hurt anything. It's not like there's water in your car. There's always moisture in that fuel. And the filter will see that and then stop. Whereas the ethanol, it puts a coating around that, almost like a shield. Like the Enterprise.

MLT: (laugh) Yeah, right.

Kris: It puts a shield around it and lets it go through without harm or hurting the filter.

MLT: So how about the stations that have been selling ethanol blends? Coastal? Do they do that year round?

Kris: Seven-Eleven, I know does. I'm not sure about Coastal. But all the Seven-Elevens here use ethanol year round.

MLT: Do they have filters on theirs? Or...

Kris: Yes.

MLT: Yeah? If I was going to go to Seven-Eleven, try to videotape just to show what we're talking about. Where would it be, where is it?

Kris: They're in the actual dispenser that you would come up to and all this and all that stuff and there's the dispenser.

MLT: So it's actually inside and you can't see it from the outside?

Kris: No. At most, there's a lot of the stations that we retrofitted last year for some of the Conoco's and stuff like that. We had about eighty filters on the outside but most generally, all the filters and the working components of the filter are located inside.

MLT: Do any of these Conoco stations still have them?

Kris: No, they would spin them off.

MLT: They would take them off.

Kris: Because as I said, they would clog up as soon as the ethanol wasn't present in the fuel anymore. But, if you'd like, we could go take a look...

MLT: Yeah, that would be great. Thanks. And then we can have you talking and showing the pictures of the filters at the same time on there.

Kris: Ok.

MLT: Thanks a lot. It's not nearly as complicated as I thought from all the claims I got.

Pat: Oh, everbody cries before they get hurt... PEI distributors.

MLT: Oh, thanks.

Pat: It's an older list.

Kris: There is obviously the expense of putting the filter on, changing. If you go year round, you don't have to worry about switching back and forth. You know, there's an expense. More expense for a monitor filter than just a standard filter.

MLT: Yeah, I think it would probably ... (??) because we don't have any oxygenates ... (??) ... Air quality all year long.

Kris: Yeah. I'm kind of curious why you are going to ...

Pat: State legislature.

MLT: Oh, economic reasons. We ship in all our petroleum products. We got a lot of land, agricultural workers. Sugar companies are going out of business. The pineapple guys are converting to resort. A lot of things. Agricultural workers are out of jobs and the land is just sitting there. They go out of sugar and then it isn't like the land gets built on. You know, there's one company that went out of business ten years ago and it's still sitting there. Just raw sugar growing wild. It's sort of a shame. Those areas have the high employment rates.

Pat: They're basic requirements for economic reasons for one thing. Sugar cane .... (??) ... making ethanol ... (??)... the ethanol ... (??) ...

MLT: And of course, we're looking to use some kind of waste products too because we've got some golf courses. They could just take the clippings. Could make ethanol out of that stuff. And we got tons of it. I mean all year long. You know, we got yard and wood waste, piles and piles of it. Not that much industrial waste. We mostly have the green stuff. So if we could use that to make some fuel, there's some local jobs, economic benefits, less stuff going to landfills. They're looking at it. But unless you got a market for it, no one's going to produce it. So the legislature said, "Well, ok. We'll get you a market."

(at dispenser)

Bill: On this type of dispenser, the filter is located right back up in this area. There's one filter for each product. This particular dispenser is a blender so two products come in and they can select three different grades of fuel. Basically, this filter takes care of the water or you know, filtration of the product coming in.

MLT: How often do the filters get changed?

Bill: Usually, the filters get changed whenever the product starts running slow or in the beginning of the ethanol program; the ethanol has to be in the tank before the filter can be put on.

This is the monitor filter. In this case, you'd shut off the emergency valve, turn off the power to the submersible pump, come out, change the filter, put the new filter on, turn the pump back on, put it back on-line. So, it's a pretty simple process of changing filters.

MLT: That's the total process?

Bill: That's a check for water, make sure there's no water present. The ethanol blend is put into the tank. Soon, thereafter, then the filter should be changed. The filter then will control the amount of water. If there is an excess amount of water that passes through, the filter will monitor that, shut down of there is an excessive amount. So no water can enter a vehicle and possibly damage the engine and stuff like that.

MLT: How often do these get changed?

Bill: Some people go on a, maybe every six months type basis. All it really depends on is the amount of fuel that goes through the dispenser. It's hard to regulate how much or how often you have to change those filters.

MLT: How often are the non-ethanol filters changed?

Bill: Same type scenario. If you have a high volume station, it might be every four months, four to six months. If it's a fairly low volume station, maybe, once a year is sufficient.

Here, you can have this one.